



Caltrans Division of Research,
Innovation and System Information

Research Results

Transportation
Safety and
Mobility

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Project Title:

High Occupancy Vehicle (HOV)
Lane Management System

Task Number: 2187

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This task researched how to dynamically control the use of HOV lanes by single occupant hybrid vehicles to comply with the federally mandated average speed limit while simultaneously promoting the adoption of lower-emission vehicles.

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Managing the Traffic Flow in High Occupancy Vehicle (HOV) Lanes

Dynamically controlling traffic in HOV lanes to manage traffic congestion and allow access of lower emission vehicles with single occupancy

WHAT WAS THE NEED?

Effectively managing traffic congestion on California's highway system and minimizing environmental impacts are high-priority objectives for transportation management agencies. In 2005, to promote the development and use of green technologies, California initiated a program to allow a limited number of lower emission hybrid vehicles to use HOV facilities without meeting the minimum occupancy requirements. Providing single occupant hybrid vehicles (SOHV) access to HOV lanes creates a significant incentive for consumers to choose these lower emission vehicles, thus reducing the environmental impact of traffic flow.

However, because federal money was used to build most of the HOV network, the program needed to be approved by the Federal Highway Administration (FHWA). Federal regulations mandate that SOHVs be prohibited from using HOV lanes if the traffic speed falls below 45 miles per hour during 90% of the peak hours over a 180-day period. Allowing SOHVs to use HOV facilities has the potential to increase congestion and reduce speed performance in the HOV lanes. The FHWA issued conditional approval for hybrid vehicles to use HOV lanes if Caltrans could design a plan that could restrict SOHV access during periods of degraded speed performance.

WHAT WAS OUR GOAL?

The goal was to design a dynamic lane management system to indicate when SOHVs can and cannot use HOV facilities to improve the flow of traffic and comply with FHWA requirements.



Caltrans improves mobility across California by performing applied research, developing innovations, and implementing solutions.

WHAT DID WE DO?

Caltrans, in partnership with the University of California, Berkeley Partners for Advanced Transportation Technology (PATH) research center, studied the effects of permitting and restricting SOHV access to HOV lanes. The team selected a highly trafficked 26-mile segment of eastbound Interstate 210 near Pasadena to simulate various control scenarios.

The researchers designed a lane management system to control entry to HOV lanes by dynamically disseminating restriction messages on the freeway onramp. The solution uses variable message signage (VMS), which has been successful in other highway notification applications. SOHVs are allowed onto the HOV lane based on current traffic conditions gathered from live sensors and historical traffic data.

WHAT WAS THE OUTCOME?

The simulations conducted for this research showed that decreasing the number of vehicles in an HOV lane—not just SOHVs, but any vehicle—not only reduces the delay experienced by vehicles in the HOV lane, but also the total system delay. Removing 1% of the vehicles from the HOV lanes can lead to an average reduction of about 8% in the

total system delay. Removing close to 7% could reduce the system delay by about 50% on average. Although these values are specific to the geometry and demand for the highway segment researched, other HOV facilities are expected to show similar trends.

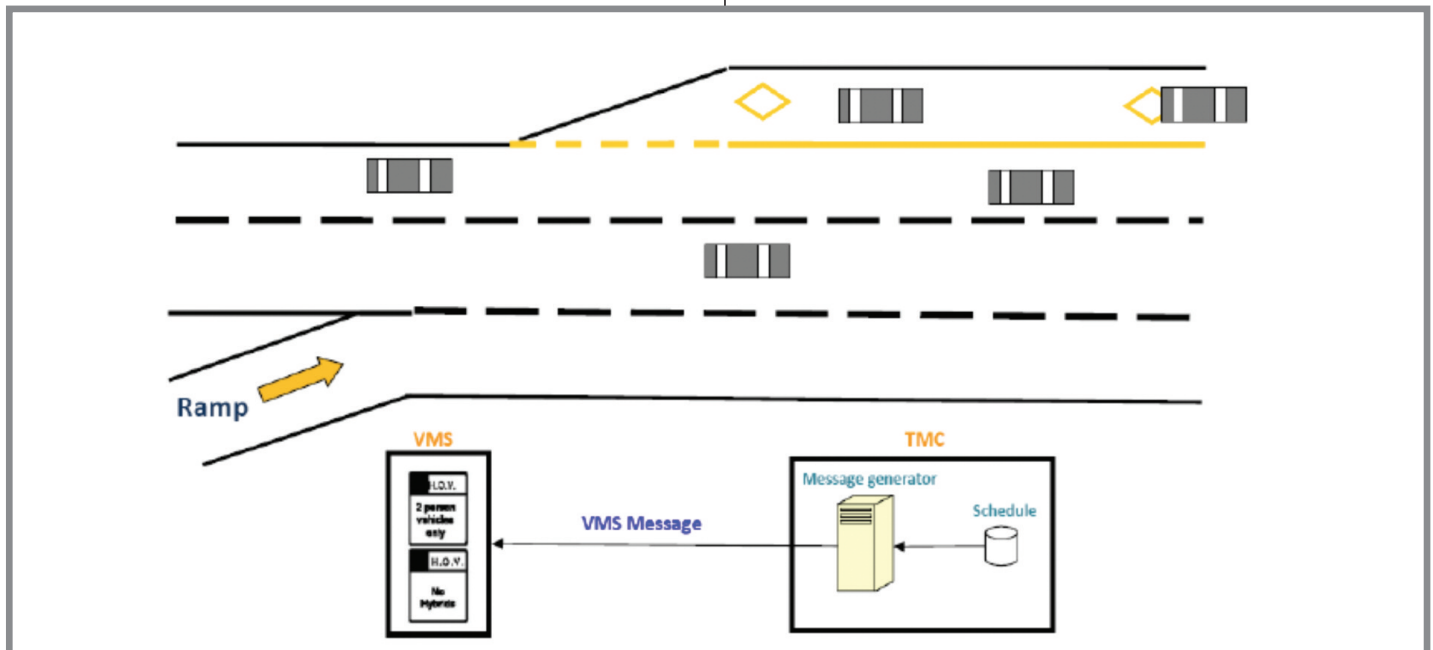
This methodology could also be used to determine the optimal pricing and operational strategies for other managed lanes, such as high occupancy toll (HOT) lanes.

WHAT IS THE BENEFIT?

The initial research was targeted to comply with FHWA requirements regarding the use of HOV lanes, however, the results proved to have broader implications in improving traffic flow. The research showed that reducing the number of vehicles allowed to enter lanes in peak traffic periods can increase the average speed. The work performed for this project is a step forward to understanding various HOV restriction scenarios and their impact on HOV lane and mainline congestion.

LEARN MORE

To view the complete report:
www.dot.ca.gov/research/researchreports/reports/2011/2011-12_task_2187-tsm.pdf



HOV lane control using a variable message sign